This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) A method for managing a network providing Input/Output (I/O) paths between a plurality of host systems and storage volumes in storage systems, comprising:

providing an application service connection definition for each of the I/O paths ~~connection~~ from a host to a storage volume;

providing at least one service level guarantee definition indicating performance criteria to satisfy service requirements included in at least one service level agreement with at least one customer for network resources;

associating each service level guarantee definition with at least one application service connection definition; [[and]]

gathering, by a virtualization controller mapping physical storage resources to virtual volumes in a virtualization layer, Input/Output (I/O) performance data for I/O requests transmitted through the I/O paths;

transmitting, by the virtualization controller, the gathered performance data to a service level agreement server;

monitoring, by the service level agreement server, whether the performance data for the I/O ~~Input/Output (I/O)~~ requests transmitted through the ~~multiple~~ I/O paths satisfy the performance criteria indicated in the service level guarantee definition associated with the application service connection definitions for the I/O path; and

transmitting, by the service level agreement server, commands to the virtualization controller to throttle I/O transmission over at least one connection in response to determining that the performance data for at least one connection does not satisfy the performance criteria.

2. (Currently Amended) The method of claim 1, wherein each service level guarantee definition is implemented as a separate element in at least one Extended Markup Language (XML) document, the element for the service level guarantee definition includes the performance criteria defined in the service level agreement, and wherein the application service

connection definition for each ~~connection~~ of the I/O paths is implemented as an element ~~in a~~ the at least one XML document, wherein [[the]] attributes of the application service connection definition element provide information on the I/O path ~~connection~~.

3. (Original) The method of claim 1, wherein multiple service level guarantee definitions indicating different performance criteria are associated with different sets of application service connection definitions.

4. (Currently Amended) The method of claim 3, wherein the application service definition for ~~one connection~~ the I/O paths may be associated with the multiple service level guarantee definitions, wherein the monitoring comprises determining whether the I/O requests transmitted through ~~one connection~~ the I/O paths satisfy the performance criteria of all associated service level guarantee definitions.

5. (Currently Amended) The method of claim 1, further comprising:

providing an application service group identifying a plurality of application service connection definitions, wherein associating the at least one service level guarantee definition with the application service connection definitions comprises associating ~~each~~ the at least one service level guarantee ~~definitions~~ definition with the at least one application service group, wherein the application service connection definitions identified in the application service group are associated with the service level guarantee definition ~~definitions~~ with which their application service group is associated.

6. (Currently Amended) The method of claim 5, further comprising:

providing a service level commitment record associating one service level agreement definition with the at least one application service group.

7. (Currently Amended) The method of claim 5, wherein at least one Extended Markup Language (XML) document includes one element for each of the at least one application service group, and wherein the element for each of the at least one application service group includes one sub-element for each application service connection definition included in that

application service group, wherein each application service connection definition subelement includes attributes providing information on the application service connection definition.

8. (Currently Amended) The method of claim 1, wherein monitoring whether ~~Input/Output (I/O)~~ the I/O requests transmitted through the ~~multiple~~ I/O path ~~connection~~ satisfy performance criteria indicated in the service level guarantee definition comprises:

gathering performance information concerning I/O requests for the I/O paths ~~each connection~~;

selecting one of the at least one service level guarantee definition; and

for each ~~connection~~ of the I/O paths identified by ~~one~~ the application service connection definition associated with the selected service level guarantee definition, comparing the gathered performance information for the I/O path ~~connection~~ with the performance criteria indicated in the selected service level guarantee definition.

9. (Original) The method of claim 8, further comprising:

adjusting operations among the I/O paths represented by the application service connection definitions associated with the selected service level guarantee definition if the gathered performance information for the I/O paths does not satisfy the performance criteria.

10. (Currently Amended) The method of claim 9, wherein adjusting the operations comprises:

determining the I/O paths that are over performing and under performing with respect to the performance criteria; and

throttling the transmission of the I/O requests through the determined I/O paths that are over performing.

11. (Currently Amended) The method of claim 10, wherein throttling the transmissions comprises delaying the processing of the I/O requests transmitted through the over performing I/O paths.

12. (Currently Amended) The method of claim 8, wherein the gathering of the performance information for the I/O paths comprises determining an I/O response time and I/O demand at the I/O paths and comparing the determined I/O response time and the I/O demand with the performance criteria for the I/O response time and the I/O demand in the selected service level guarantee definition.

13. (Currently Amended) The method of claim 12, wherein the I/O demand comprises I/O operations per second per unit of contracted storage capacity and I/O throughput per contracted storage capacity.

14. (Currently Amended) The method of claim 13, wherein one of the I/O paths ~~a connection~~ is under performing if a percentage of I/O response times measured for the ~~connection~~ I/O path is less than a percentage guarantee indicated in the selected service level guarantee definition.

15. (Currently Amended) The method of claim 13, wherein ~~a connection~~ one of the I/O paths is under performing if the I/O demand exceeds [[the]] a demand criteria indicated in the service level guarantee definition and a sampling of the ~~measured~~ determined I/O response time ~~times~~ is less than [[the]] a response time criteria indicated in the service level guarantee definition.

16. (Canceled)

17. (Currently Amended) The method of claim [[16]] 1, wherein the network comprises a Storage Area Network (SAN) ~~and the performance gateways are implemented in a virtualization controller, and wherein the storage volumes comprise logical volumes in a virtualization layer implemented in the virtualization controller~~.

18. (Currently Amended) The method of claim 1, wherein the at last one application service connection definition ~~connections~~, the at least one service level agreement ~~guarantees~~, and the at least one service level guarantee definition ~~definitions~~, ~~application service definitions~~

~~information, and the monitoring of the I/O requests~~ are provided by [[a]] the service level agreement server in a web service architecture that interfaces with a client to provide real time performance information on the I/O paths to the client.

19. (Currently Amended) A system for managing a network providing Input/Output (I/O) paths between a plurality of host systems and storage volumes in storage systems, comprising:

~~a processing unit;~~

~~code executed by the processing unit to cause operations to be performed, the operations comprising:~~

a service level agreement server having a computer readable medium including:

[[(i)]] providing an application service connection definition for each ~~connection~~ of the I/O paths from one of the host systems ~~a host~~ to [[a]] one of the storage [[volume]] volumes;

[[(ii)]] providing at least one service level guarantee definition indicating performance criteria to satisfy service requirements included in at least one service level agreement with at least one customer for network resources;

[[(iii)]] associating each service level guarantee definition with at least one application service connection definition; and

a virtualization controller mapping physical storage resources to virtual volumes in a virtualization layer, wherein the virtualization controller performs operations, the operations comprising:

gathering Input/Output (I/O) performance data for I/O requests transmitted through the I/O paths;

transmitting the gathered performance data to the service level agreement server;

wherein the service level agreement server further performs operations, the operations comprising:

[[(iv)]] monitoring whether the performance data for the I/O ~~Input/Output (I/O)~~ requests transmitted through the ~~multiple~~ I/O paths satisfy the performance criteria indicated in the service level guarantee definition associated with the application service connection definitions for the I/O paths; and

transmitting commands to the virtualization controller to throttle I/O transmission over at least one of the I/O paths in response to determining that the performance data for at least one of the I/O paths does not satisfy the performance criteria.

20. (Currently Amended) The system of claim 19, wherein the service level agreement server computer readable medium further includes ~~further comprising~~:

~~a storage medium including~~ at least one Extended Markup Language (XML) document having:

(i) a separate element for ~~each~~ the at least one service level guarantee definition, wherein the element for the service level guarantee definition includes the performance criteria defined in the service level agreement; and

(ii) a separate element for each application service connection definition for each, wherein [[the]] attributes of the application service connection definition element provide information on the I/O path ~~connection~~.

21. (Original) The system of claim 19, wherein multiple service level guarantee definitions indicating different performance criteria are associated with different sets of application service connection definitions.

22. (Currently Amended) The system of claim 21, wherein the application service definition for ~~one connection~~ the I/O paths may be associated with the multiple service level guarantee definitions, wherein the monitoring comprises determining whether the I/O requests transmitted through ~~one connection~~ the I/O paths satisfy the performance criteria of all associated service level guarantee definitions.

23. (Currently Amended) The system of claim 19, wherein the operations further comprise:

providing an application service group identifying a plurality of application service connection definitions, wherein associating the at least one service level guarantee definition with the application service connection definitions comprises associating ~~each~~ the at least one of the service level guarantee definitions with the at least one application service group, wherein the

application service connection definitions identified in the application service group are associated with the service level guarantee definitions with which their application service group is associated.

24. (Currently Amended) The ~~method~~ system of claim 23, further comprising:

a storage medium having at least one Extended Markup Language (XML) document that includes one element for each of the at least one application service group, and wherein the element for each of the at least one application service group includes one sub-element for each application service connection definition included in that application service group, wherein each application service connection definition subelement includes attributes providing information on the application service connection definition.

25. (Currently Amended) The system of claim 19, wherein monitoring whether ~~Input/Output (I/O)~~ the I/O requests transmitted through the ~~multiple~~ I/O paths satisfy the performance criteria indicated in the service level guarantee definition comprises:

gathering performance information concerning the I/O requests for the I/O paths ~~each connection~~;

selecting one of the at least one service level guarantee definition; and

for each ~~connection~~ of the I/O paths identified by ~~one~~ the at least one application service connection definition associated with the selected service level guarantee definition, comparing the gathered performance information for the I/O path ~~connection~~ with the performance criteria indicated in the selected service level guarantee definition.

26. (Currently Amended) The system of claim 25, wherein the operations further comprise:

adjusting the operations among the I/O paths represented by the application service connection definitions associated with the selected service level guarantee definition if the gathered performance information for the I/O paths does not satisfy the performance criteria.

27. (Currently Amended) The system of claim 26, wherein adjusting the operations comprises:

determining the I/O paths that are over performing and under performing with respect to the performance criteria; and

throttling the transmission of the I/O requests through the determined I/O paths that are over performing.

28. (Currently Amended) The system of claim 25, wherein the gathering of the performance information for the I/O paths comprises determining an I/O response time and I/O demand at the I/O paths and comparing the determined I/O response time and the I/O demand with the performance criteria for response time and demand in the selected service level guarantee definition.

29. (Canceled)

30. (Currently Amended) The system of claim 19, wherein the ~~processing unit comprises a~~ service level agreement server [[in]] implements a web service architecture that interfaces with a client to provide real time performance information on the I/O paths to the client.

31. (Currently Amended) An article of manufacture for managing a network providing Input/Output (I/O) paths between a plurality of host systems and storage volumes in storage systems, wherein the article of manufacture causes operations to be performed, the operations comprising:

providing an application service connection definition for each of the I/O paths ~~connection from a host to a storage volume~~;

providing at least one service level guarantee definition indicating performance criteria to satisfy service requirements included in at least one service level agreement with at least one customer for network resources;

associating each service level guarantee definition with at least one application service connection definition; [[and]]

gathering, by a virtualization controller mapping physical storage resources to virtual volumes in a virtualization layer, Input/Output performance data for Input/Output requests transmitted through the I/O paths;

transmitting, by the virtualization controller, the gathered performance data to a service level agreement server;

monitoring, by the service level agreement server, whether the performance data for the I/O ~~Input/Output (I/O)~~ requests transmitted through the ~~multiple~~ I/O paths satisfy the performance criteria indicated in the service level guarantee definition associated with the application service connection definitions for the I/O paths; and

transmitting, by the service level agreement server, commands to the virtualization controller to throttle I/O transmission over at least one of the I/O paths in response to determining that the performance data for at least one of the I/O paths does not satisfy the performance criteria.

32. (Currently Amended) The article of manufacture of claim 31, wherein each service level guarantee definition is implemented as a separate element in at least one Extended Markup Language (XML) document, the element for the service level guarantee definition includes the performance criteria defined in the service level agreement, and wherein the application service connection definition for each of the I/O paths ~~connection~~ is implemented as an element in [[a]] the at least one XML document, wherein [[the]] attributes of the application service connection definition element provide information on the I/O path ~~connection~~.

33. (Original) The article of manufacture of claim 31, wherein multiple service level guarantee definitions indicating different performance criteria are associated with different sets of application service connection definitions.

34. (Currently Amended) The article of manufacture of claim 33, wherein the application service definition for ~~one connection~~ each of the I/O paths may be associated with the multiple service level guarantee definitions, wherein the monitoring comprises determining whether the I/O requests transmitted through ~~one connection~~ the I/O paths satisfy the performance criteria of all associated service level guarantee definitions.

35. (Currently Amended) The article of manufacture of claim 31, wherein the operations further comprise:

providing an application service group identifying a plurality of application service connection definitions, wherein associating the at least one service level guarantee definition with the application service connection definitions comprises associating ~~each~~ the at least one service level guarantee definitions with at least one application service group, wherein the application service connection definitions identified in the application service group are associated with the service level guarantee ~~definitions~~ definition with which their application service group is associated.

36. (Currently Amended) The article of manufacture of claim 35, wherein at least one Extended Markup Language (XML) document includes one element for each of the at least one application service group, and wherein the element for each of the at least one application service group includes one sub-element for each application service connection definition included in that application service group, wherein each application service connection definition subelement includes attributes providing information on the application service connection definition.

37. (Currently Amended) The article of manufacture of claim 36, wherein the operations further comprise:

providing a service level commitment record associating one service level agreement definition with the at least one application service group.

38. (Currently Amended) The article of manufacture of claim 31, wherein monitoring whether the I/O ~~Input/Output (I/O)~~ requests transmitted through the ~~multiple~~ I/O paths satisfy the performance criteria indicated in the service level guarantee definition comprises:

gathering performance information concerning the I/O requests for ~~each~~ the I/O paths ~~connection~~;

selecting one of the at least one service level guarantee definition; and

for ~~each~~ the I/O path ~~connection~~ identified by [[one]] the application service connection definition associated with the selected service level guarantee definition, comparing the gathered performance information for the connection with the performance criteria indicated in the selected service level guarantee definition.

39. (Currently Amended) The article of manufacture of claim 38, wherein the operations further comprise:

adjusting the operations among the I/O paths represented by the application service connection definitions associated with the selected service level guarantee definition if the gathered performance information for the I/O paths does not satisfy the performance criteria.

40. (Currently Amended) The article of manufacture of claim 39, wherein adjusting the operations comprises:

determining the I/O paths that are over performing and under performing with respect to the performance criteria; and

throttling the transmission of the I/O requests through the determined I/O paths that are over performing.

41. (Currently Amended) The article of manufacture of claim 40, wherein throttling the transmissions comprises delaying the processing of the I/O requests transmitted through the over performing I/O paths.

42. (Currently Amended) The article of manufacture of claim 38, wherein the gathering of the performance information for the I/O paths comprises determining an I/O response time and I/O demand at the I/O paths and comparing the determined I/O response time and the I/O demand with the performance criteria for response time and demand in the selected service level guarantee definition.

43. (Currently Amended) The article of manufacture of claim 42, wherein the I/O demand comprises I/O operations per second per unit of contracted storage capacity and I/O throughput per contracted storage capacity.

44. (Original) The article of manufacture of claim 43, wherein a connection is under performing if a percentage of I/O response times measured for the connection is less than a percentage guarantee indicated in the selected service level guarantee definition.

45. (Currently Amended) The article of manufacture of claim 43, wherein one of the I/O paths ~~a connection~~ is under performing if the I/O demand exceeds the demand criteria indicated in the service level guarantee definition and a sampling of the measured I/O response times is less than the response time criteria indicated in the service level guarantee definition.

46. (Currently Amended) The article of manufacture of claim 31, wherein the at least one application service connection definition ~~connections~~, the at least one service level agreement ~~guarantees~~, the at least one service level guarantee definition ~~definitions, application service definitions information, and the monitoring of the I/O requests~~ are provided by [[a]] the service level agreement server in a web service architecture that interfaces with a client to provide real time performance information on the I/O paths to the client.

47. (Currently Amended) A system for managing a network providing Input/Output (I/O) paths between a plurality of host systems and storage volumes in storage systems, comprising:

means for providing an application service connection definition for each of the I/O paths ~~connection from a host to a storage volume~~;

means for providing at least one service level guarantee definition indicating performance criteria to satisfy service requirements included in at least one service level agreement with at least one customer for network resources;

means for associating each service level guarantee definition with at least one application service connection definition; [[and]]

means for gathering, by a virtualization controller mapping physical storage resources to virtual volumes in a virtualization layer, Input/Output (I/O) performance data for I/O requests transmitted through the I/O paths;

means for transmitting, by the virtualization controller, the gathered performance data to a service level agreement server;

means for monitoring, by the service level agreement server, whether the performance data for the I/O ~~Input/Output (I/O)~~ requests transmitted through the ~~multiple~~ I/O paths satisfy the performance criteria indicated in the service level guarantee definition associated with the application service connection definitions for the I/O paths; and

means for transmitting, by the service level agreement server, commands to the virtualization controller to throttle I/O transmission over at least one connection in response to determining that the performance data for at least one connection does not satisfy the performance criteria.

48. (Currently Amended) The system of claim 47, wherein multiple service level guarantee definitions indicating different performance criteria are associated with different sets of the application service connection definitions.

49. (Currently Amended) The system of claim 47, further comprising:

means for providing an application service group identifying a plurality of application service connection definitions, wherein associating the service level guarantee definition with the application service connection definitions comprises associating each service level guarantee definitions with at least one application service group, wherein the application service connection definitions identified in the application service group are associated with the service level guarantee definitions with which their application service group is associated.